WHAT IS CLAIMED IS:

1. A pressure transmitter adapted to couple to a process fluid to sense pressure, the pressure transmitter comprising:

a pressure sensor adapted to measure pressure of the process fluid;

an analog to digital converter coupled to the pressure sensor and configured to generate a series of digital representations of pressure of the process fluid;

a microprocessor system configured to receive the series of digital representations of pressure and having:

a first algorithm stored therein calculating a difference between the series of digital representations and a moving average of the series of digital representations, and having

a second algorithm stored therein receiving the difference and calculating a trained data set of historical data during a training mode and calculating a current data set during a monitoring mode and generating diagnostic data as a function of the current data set relative to the historical data, the diagnostic data indicative of a condition of a primary element and/or an impulse line; and

an output configured to provide an output related to pressure of the process fluid.

2. The pressure transmitter of claim 1 wherein the microprocessor system stores the trained data set.

3. The pressure transmitter of claim 1 wherein the moving average is calculated according to the series

$$A_j = \sum_{k=0}^{m} (P_{j+k}) \ (W_k)$$

where A is the moving average, P is a series of sensed pressure values, and W is a weight for a sensed pressure value, m is a number of previous sensed pressure values in the series.

4. The pressure transmitter of claim 1 wherein the trained data set comprises statistical data.

5. The pressure transmitter of claim 1 wherein the microprocessor system switches from the training mode to the monitoring mode.

6. The pressure transmitter of claim 5 wherein the microprocessor system stores the trained data set in the training mode.

7. The pressure transmitter of claim 1 wherein the diagnostic data indicates a condition of a pressure generator.

8. The pressure transmitter of claim 1 wherein the diagnostic data indicates a condition of a primary flow element.

9. The pressure transmitter of claim 1 wherein the output comprises a calibrated output which is adjusted based upon the diagnostic data.

10. The pressure transmitter of claim 1 wherein the trained data set of historical data is related to power spectral density of the difference.

11. The pressure transmitter of claim 10 wherein the power spectral density data is in the range of 0 to 100 Hertz.

12. The pressure transmitter of claim 1 wherein the diagnostic circuit implements a diagnostic algorithm selected from the group of algorithms consisting of neural networks, fuzzy logic, wavelets and Fourier transforms.

13. The pressure transmitter of claim 1 wherein the pressure sensor comprises a differential pressure sensor.

14. The pressure transmitter of claim 1 wherein the pressure sensor comprises an absolute pressure sensor.

15. The pressure transmitter of claim 1 wherein the pressure sensor comprises a gauge pressure sensor.

16. The pressure transmitter of claim 1 wherein the diagnostic data provides a predictive indication of a future occurrence of a diagnostic condition.

17. The pressure transmitter of claim 1 wherein the current data set and historical data comprise time domain data.

18. The pressure transmitter of claim 1 wherein the current data set and historical data comprise frequency domain data.

19. A pressure transmitter adapted to couple to a process via an impulse line to sense a pressure of process fluid, the pressure transmitter comprising:

a pressure sensor adapted to couple to the impulse line;

a measurement circuit coupled to the sensor and generating an output related to sensed pressure;

a difference circuit coupled to the sensor and configured to generate a difference output representing the sensed pressure minus a moving average;

a calculate circuit receiving the difference output, configured to calculate a trained output of historical data obtained during training, and to calculate a monitor output of current data obtained during monitoring; and

a diagnostic circuit configured to receive the trained output and the monitor output and generate a diagnostic output indicating a current condition of the impulse line.

20. The pressure transmitter of claim 19 wherein the pressure sensor include a remote seal.

21. The pressure transmitter of claim 20 wherein the sensed pressure output is a indicative of a quantity of fluid in a tank.

22. The pressure transmitter of claim 21 further including a wet leg.

23. The pressure transmitter of claim 21 further including a dry leg.

24. The pressure transmitter of claim 19 wherein the calculate circuit stores the historical data.

25. The pressure transmitter of claim 19 wherein the moving average is calculated according to the series

$$A_j = \sum_{k=0}^{m} (P_{j+k}) \ (W_k)$$

where A is the moving average, P is a series of sensed pressure values, and W is a weight for a sensed pressure value, m is a number of previous sensed pressure values in the series.

26. The pressure transmitter of claim 19 wherein the historical data comprises statistical data.

27. The pressure transmitter of claim 19 wherein the output relate to sensed pressure comprises a

calibrated output and which is adjusted based upon the diagnostic output.

28. The pressure transmitter of claim 19 wherein the historical data comprises power spectral density of the difference output.

29. The pressure transmitter of claim 28 wherein the power spectral density data is in the range of 0 to 100 Hertz.

30. The pressure transmitter of claim 19 wherein the diagnostic circuit implements a diagnostic algorithm selected from the group of algorithms consisting of neural networks, fuzzy logic, wavelets and Fourier transforms.

31. The pressure transmitter of claim 19 wherein the pressure sensor comprises a differential pressure sensor.

32. The pressure transmitter of claim 19 wherein the pressure sensor comprises an absolute pressure sensor.

33. A transmitter adapted to measure process flow, comprising,

a pressure sensor adapted to sense pressure of a process fluid;

a difference circuit coupled to the sensor and configured to generate a difference output representing the sensed pressure minus a moving average;

a calculate circuit configured to receive the difference output and calculate a trained output of historical data obtained during training and to calculate a monitor output of current data obtained during monitoring; and

a diagnostic circuit configured to receive the trained output and the monitor output and to generate a diagnostic output indicative of a condition of a primary element and/or an impulse line of the transmitter.

34. The fluid flow meter of claim 33 wherein the historical data comprises power spectral density of the difference output.

35. The pressure transmitter of claim 33 wherein the pressure sensor comprises a differential pressure sensor.

36. The pressure transmitter of claim 33 wherein the pressure sensor comprises an absolute pressure sensor.

37. The pressure transmitter of claim 33 wherein the diagnostic output provides a predictive indication of a future occurrence of a diagnostic condition.

38. The pressure transmitter of claim 33 wherein the current data and historical data comprise time domain data.

39. The pressure transmitter of claim 33 wherein the current data and historical data comprise frequency domain data.

40. The flowmeter of claim 33 wherein the diagnostic current implements a diagnostic algorithm selected from the group of algorithms consisting of neural networks, fuzzy logic, wavelets and Fourier transforms.

41. A diagnostic method for diagnosing a pressure transmitter coupled to a process fluid, the method comprising:

calculating a difference between a pressure sensed by the pressure transmitter and a moving average of the sensed pressure;

acquiring and storing an historical data set of the calculated difference during a train mode of the pressure transmitter;

acquiring and storing a current data set of the calculated difference during a monitoring mode of the pressure transmitter; and

comparing the current data set to the historical data set to diagnose the condition of a primary element and/or an impulse line of the pressure transmitter.

42. The method of diagnosis of claim 41 wherein the historical data set comprises statistical data on the calculated difference.

43. The method of diagnosis of claim 42 wherein the current data set comprises current data on the sample average ($\underline{X}$) and sample deviation (s) of the calculated difference.

44. The method of diagnosis of claim 43 wherein the sample average ($\underline{X}$) is compared to the mean (μ) to diagnose erosion of the primary element.

45. The method of diagnosis of claim 44 wherein the sample deviation (s) is compared to the standard deviation (σ) to diagnose impulse line plugging.

46. The method of diagnosis of claim 41 wherein the historical data set comprises data on the power spectral density of the calculated difference.

47. The method of diagnosis of claim 46 wherein the current data set comprises power spectral density of the calculated difference.

48. The method of diagnosis of claim 41 wherein the comparing includes performing a diagnostic algorithm selected from the group of algorithms consisting of neural networks, fuzzy logic, wavelets and Fourier transforms.

49. A transmitter configured to perform the method of claim 41.

50. Control room equipment configured to perform the method of claim 41.

51. The method of claim 41 wherein the pressure comprises a differential pressure.

52. The method of claim 41 wherein the pressure comprises an absolute pressure sensor.

53. The method of claim 41 wherein the diagnostic output provides a predictive indication of a future occurrence of plugging of the impulse line.

54. The method of claim 41 wherein the current data set and historical data comprise time domain data.

55. The method of claim 41 wherein the current data set and historical data comprise frequency domain data.

56. A computer-readable medium having stored thereon instructions executable by a microprocessor system to cause the microprocessor system to perform a diagnostic operation on a pressure transmitter coupled to a process fluid, the instructions comprising:

calculating a difference between a pressure sensed by the pressure transmitter and a moving average of the sensed pressure;

acquiring and storing an historical data set of the calculated difference during a train mode of the pressure transmitter;

acquiring and storing a current data set of the calculated difference during a

monitoring mode of the pressure transmitter; and

comparing the current data set to the historical data set to diagnose the condition of a primary element and/or an impulse line of the pressure transmitter.

57. A pressure transmitter adapted to couple to a process fluid to sense process pressure, the pressure transmitter comprising:

a pressure sensor for sensing process pressure;

differencing means for generating a difference output representing the sensed pressure minus a moving average;

calculating means for receiving the difference output for calculating a trained output of historical data obtained during training and for calculating a monitor output of current data obtained during monitoring; and

diagnosing means for receiving the trained output and the monitor output, generating a diagnostic output and diagnosing a current condition of a primary element and/or an impulse line of the pressure transmitter.

58. A pressure transmitter for coupling to a process control loop and providing an output related to a pressure of process fluid, comprising:

a pressure sensor adapted to measure a pressure of the process fluid and responsively provide a sensor output;

impulse piping configured to couple the pressure sensor to the process fluid;

computation circuitry adapted to calculate a statistical parameter of the pressure sensor output;

memory adapted to contain a baseline statistical parameter of the pressure sensor output;

diagnostic circuitry configured to compare the stored baseline statistical parameter of the pressure sensor output to a current statistical parameter and responsively provide a diagnostic output based upon the comparison, the diagnostic output indicative of a condition of a primary element and/or an impulse line of the pressure transmitter

output circuitry to provide an output related to the sensed pressure.

59. The transmitter of claim 58 wherein the statistical parameter comprises standard deviation.

60. The transmitter of claim 58 wherein the diagnostic circuitry comprises fuzzy logic which employs a membership function.

61. The transmitter of claim 59 including a fuzzy membership function stored in the memory and

wherein diagnostic circuitry applies the membership function to the statistical parameter.

62. The transmitter of claim 58 wherein the pressure sensor comprises a differential pressure sensor.

63. The transmitter of claim 58 wherein the statistical parameter comprises power spectral density.

64. The transmitter of claim 58 wherein the baseline impulse piping is related to substantially new impulse piping.

65. The transmitter of claim 58 wherein the diagnostic circuit implements a diagnostic algorithm selected from the group of algorithms consisting of neural networks, fuzzy logic, wavelets and Fourier transforms.

66. The pressure transmitter of claim 58 wherein the pressure sensor comprises a differential pressure sensor.

67. The pressure transmitter of claim 58 wherein the pressure sensor comprises an absolute pressure sensor.

68. The pressure transmitter of claim 58 wherein the pressure sensor comprises a gauge pressure sensor.

69. The pressure transmitter of claim 58 wherein the diagnostic output provides a predictive indication of a future occurrence of plugging of the impulse line.

70. The pressure transmitter of claim 58 wherein the baseline and historic statistical parameter comprise time domain data.

71. The pressure transmitter of claim 58 wherein the baseline and historic statistical parameter comprise frequency domain data.

72. A method for detecting a degrading of impulse piping used to couple a pressure transmitter to a process fluid in a process control system, comprising:

obtaining a pressure measurement signal related to pressure of a process fluid;

retrieving a baseline statistical parameter from a memory;

calculating a current statistical parameter of the pressure measurement signal;

comparing the baseline statistical parameter to the current statistical parameter; and

providing a diagnostic output based upon the step of comparing, the diagnostic output indicative of a condition of a primary element and/or an impulse line of the pressure transmitter.

73. The method of claim 72 wherein comparing includes performing a fuzzy logic operation.

74. The method of claim 72 wherein calculating includes calculating standard deviation.

75. The method of claim 72 wherein the pressure sensor comprises a differential pressure sensor.

76. The method of claim 72 wherein the baseline is related to new impulse piping.

77. The method of claim 72 wherein the comparing implements an algorithm selected from the group of algorithms consisting of neural networks, fuzzy logic, wavelets and Fourier transforms.

78. The method of claim 72 wherein the pressure measurement comprises a differential pressure sensor.

79. The method of claim 72 wherein the pressure measurement comprises an absolute pressure sensor.

80. The method of claim 72 wherein the diagnostic output provides a predictive indication of a future occurrence of plugging of the impulse line.

81. The method of claim 72 wherein the baseline and current statistical parameter comprise time domain data.

82. The method of claim 72 wherein the baseline and current statistical parameter comprise frequency domain data.